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Health Economics

DOI:
[10.1002/hec.3530](https://doi.org/10.1002/hec.3530)

Published: 01/01/2018

Peer reviewed version

[Cyswllt i'r cyhoeddiad / Link to publication](#)

Dyfyniad o'r fersiwn a gyhoeddwyd / Citation for published version (APA):
Alam, M. F., Cohen, D., Dunstan, F., Hughes, D., & Routledge, P. A. (2018). Impact on the phased abolition of co-payments on the utilisation of selected prescription medicines in Wales. *Health Economics*, 27(1), 236-243. <https://doi.org/10.1002/hec.3530>

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IMPACT OF THE PHASED ABOLITION OF CO-PAYMENTS ON THE UTILISATION OF SELECTED PRESCRIPTION MEDICINES IN WALES

KEYWORDS: co-payment, price-elasticity, dispensing, difference-in-difference

ABSTRACT

We have taken advantage of a natural experiment to measure the impact of the phased abolition of prescription co-payments in Wales. We investigated three study periods covering the phased abolition: from £6 to £4, £4 to £3 and £3 to £0. A difference-in-difference modelling was adopted and applied to monthly UK general practice level dispensing data on 14 selected medicines which had the highest percentage of items dispensed subject to a co-payment prior to abolition. Dispensing from a comparator region (North East of England) with similar health and socio-economic characteristics to Wales, and where prescription co-payments continued during the study periods, were used to isolate any non-price effects on dispensing in Wales. Results show a small increase in dispensing of 14 selected medicines versus the comparator. Compared with NE England, monthly average Welsh dispensing was increased by 11.93 items (7.67%; 95% CI: 7.2% to 8.1%), 6.37 items (3.38%; 95% CI: 2.9% to 3.7%) and 9.18 items (4.54%; 95% CI: 4.2% to 4.9%) per practice per 1000 population during the periods when co-payment was reduced. Price elasticities of the selected medicines utilisation were -0.23, -0.13 and -0.04 in three analyses, suggesting the abolition of co-payment had small effect on Welsh dispensing.

1. INTRODUCTION

Globally, there has been a substantial growth in government health expenditure due to increased health care costs (Dieleman et al., 2016). To offset some of these costs, co-payment systems have been an aspect of healthcare in many countries (Austvoll-Dahlgren *et al.*, 2008), including the UK, where co-payment for prescription medicines has been in the form of a flat fee per item dispensed to NHS patients.

A unified approach to prescription co-payment had been applied across all parts of the UK (England, Wales, Scotland and Northern Ireland) up to 2000 when the Welsh Assembly Government froze the co-payment at its then current level of £6 per item. A phased reduction began in October 2004, with abolition in April 2007. During this period, the co-payment increased steadily in nominal terms in other parts of the UK, but in real terms was virtually constant.

<Figure I here>

Assessment of the effects of the Welsh policy provided two unique opportunities. First, whereas all previous studies in the UK and most other countries examined the effects of increasing costs to patients, the new Welsh policy allowed examination of the effects of reducing and ultimately abolishing them. Second, the Welsh policy provided a natural experiment which, for the first time, allowed a comparison of dispensing rates between a geographical area which experienced a significant change in the co-payment with another where it remained broadly constant after taking account of inflation.

The international literature consistently shows that an increase in co-payment leads to a decrease in the probability of prescription use, the number of drugs utilised and prescription drugs expenditures (Goldman *et al.*, 2007; Leibowitz *et al.*, 1985; McManus *et al.*, 1996; Tamblyn *et al.*, 2001; Lexchin and Grootendorst, 2004). Price elasticity of utilisation is a common, unitless measure which describes the responsive of demand for prescription medicines (Gemmill *et al.*, 2008). The relationship between co-payment and drug utilization can be seen in reviews by Barnieh et al. (2013), Gemmill et al. (2008) and Gibson et al. (2005). Several previous studies have estimated the price elasticity of prescription medicines utilisation in the UK mainly using national-level, aggregated dispensing data and producing price elasticity estimates ranging from -0.64 to -0.09 (Ryan and Birch, 1991; Lavers, 1989; Hughes and McGuire, 1995; O'Brien, 1989). While estimates from other countries are mainly in line with this (Puig-Junoy, 1988; Van Vliet, 1999; Smith, 1993; Motheral and Henderson, 1999; Klick and Stratmann, 2005; Street *et al.*, 1999; Fiorio and Siciliani, 2010; Grootendorst and Levine, 2001), there remains significant heterogeneity, since the type of data used, method of analysis applied, subpopulations considered and other factors vary across studies (Gemmill *et al.*, 2008).

Although in the UK prescriptions for certain medical conditions are exempt from co-payment, most exemptions relate to individuals regardless of their condition. These include *inter alia* older people, children, pregnant women, NHS in-patients and those receiving various forms of income support. As a result approximately half the UK population has always been exempt from co-payment (Walley, 1998). In 2003/4, 89% of items dispensed in the community in Wales were not subject to co-payment (Health Solutions Wales, 2004). Any effect of policy changes on total dispensing would therefore be mitigated by the fact that dispensing of most medicines would be only minimally affected if at all.

We aimed to estimate the relationship between changes in prescription co-payments and changes in dispensing rates in Wales during the period October 2003 to March 2008 focussing on those medicines which had the highest number of items dispensed *with* a co-payment prior to abolition as these are the ones most likely to be affected by any changes to co-payments.

2. METHODS

The utilisation of prescription medicines is clearly not solely a function of price and previous studies have included a range of other variables including ‘price of substitutes’, ‘sickness benefit’, ‘working population’, etc. We avoided any assumptions of confounding effects by using North East England as a comparator area which closely resembles Wales in terms of key health and socioeconomic characteristics (Table I). Further, we surveyed all Health Boards in Wales and all Primary Care Trusts in NE England (essentially the bodies which receive funding to secure or provide health care to those living in defined geographical areas) to identify any differences in local prescribing policies and initiatives which could have differentially impacted on dispensing rates. Although there was evidence of some local factors that might have influenced dispensing rates, responses from both areas were broadly in accord (Cohen *et al.*, 2010). We could therefore conclude that the influence on dispensing rates of all factors other than price was likely to be similar for the two areas over the period of study. *<Table I here>*

We selected the 14 medicines (strictly, 15 but with two strengths of amoxicillin; Table II) from a list of the 100 dispensed medicinal preparations that most frequently incurred a co-

payment in Wales in April 2005. No medicine had more than 25% of items dispensed subject to co-payment in Wales that year. A minimum percentage of items dispensed subject to co-payment (4%) was used to ensure representation of treatments for a range of conditions, both chronic and acute, and included products also available without prescription, although at reduced dose, under supervised sale at community pharmacies: omeprazole (10mg only), co-codamol (8mg codeine/500mg paracetamol only) and simvastatin (10mg only).

<Table II here>

GP practices in Wales were considered as being ‘treated’ by the changes in co-payment policy (intervention), while practices in NE England were not (control). We employed a difference-in-difference (DiD) approach (Cameron, 2005; Blundell and MaCurdy, 1999) to measure this effect. During the course of phased abolition, a total of four interventions took place: a reduction from £6 to £5, £5 to £4, £4 to £3 and £3 to £0. The second intervention (from £5 to £4) took place in April 2005 which was only six months after the first intervention in October 2004. The remaining two interventions occurred yearly thereafter. We considered a 12-month pre-intervention and 12-month post-intervention period. For consistency, we excluded the six month time window of the second intervention period (October 2004 to March 2005) from the analysis.

2.1. ANALYSIS

The econometric model is shown in equation (1) using 24 months practice-level time series dispensing data. The outcome, Y_{it} , measures the dispensing rate (number of items per 1000 population) dispensed by practice i in month t , and is modelled as a function of practice fixed effects (u_i) and time fixed effects (v_t) and random error term with zero mean (ε_{it}). We define

a variable $AREA_{it}$ which takes a value 1 if the practice is in Wales and another variable $INTV_{it}$ which equals 1 if the observation belongs to the period after the policy intervention.

$$Y_{it} = \alpha_I + u_i + v_t + w_s + \delta INTV_{it} + \lambda AREA_{it} + \gamma AREA_{it} * INTV_{it} + \varepsilon_{it} \quad (1)$$

The time fixed effects are months over two-year time-window that are represented by 23 dummy variables, with October 2003 being the reference category. The use of monthly dummies in model (1) accounts for time trends and their coefficients show how the mean dispensing rates change over time, conditional on practice effects. The model is also adjusted for season, w_s (3 quarterly dummies, with ‘October to December’ being considered as the reference category and not included in the model). The coefficient of the interaction term, γ , indicates how dispensing rates differed between Wales and NE England in the last 12 months after the policy intervention, conditional on the practice and time effects.

The variance of a practice dispensing rate is inversely proportional to practice list size and these varied substantially between practices, hence model (1) is weighted by list size. The effect is to give more weight to large practices whose rates are likely to show smaller random fluctuations than small practices.

As a DiD approach assumes that trends in intervention and control areas are similar before introducing the intervention, we carried out a pre-trends test over 3 separate pre-intervention time periods (1 = October 2003 to September 2004, 2 = April 2005 to March 2006, 3 = April 2006 to March 2007) in line with Sutton *et al.* (2012), and given in equation (2).

$$Y_{it} = \alpha_2 + u_i + \beta * t + \rho AREA_{it} * t + \varepsilon_{it} \quad (2)$$

where t represents the month since the start of the data point, β is an estimate of the monthly trend in NE England and ρ is the difference in monthly trend between Wales and NE England. The null hypothesis is that $\rho = 0$.

The regression models were estimated using a weighted least-square method, with robust standard error corrected for heteroscedasticity. A crude price elasticity of prescription medicines utilisation in Wales was then calculated using the formula,

$$\text{Price elasticity} = \frac{\text{Percentage change in average medicines utilisation}}{\text{Percentage change in average prescription co-payment}}$$

Since the study investigated interventions covering three time windows, our Analysis 1 covers a study period of two years when co-payment was £6 and £4, Analysis 2 covers a study period of two years when co-payment was £4 and £3 and, finally, Analysis 3 covers a study period of two years when co-payment was £3 and £0 in Wales.

The study received ethics approval from the South Wales Research Ethics Committee, reference 06/WSE02/31.

3. DATA

Health Solutions Wales (HSW) provided practice list size and practice-level monthly dispensing volume data for the 14 selected medicines, for all practices in Wales ($N = 485$). The Prescription Pricing Authority (PPA) provided comparable data for all practices in NE England ($N = 393$). We included all practices and months during October 2003 to September 2004 and April 2005 to March 2006 in our first analysis (analysis 1). Similarly, all practices and months during April 2005 to March 2007 are in analysis 2 and all practices and months during April

2006 to March 2008 are in analysis 3, producing a total of $878 \times 24 = 21,072$ observations in each analysis. The same sample of practices has been used in all three analyses. Table III provides descriptive statistics of dispensing and co-payment data for three analyses covering study periods defined in section 2.

< Table III here >

4. RESULTS

Results from pre-trends testing suggest that we were not able to reject the null hypothesis in all three analyses ($\rho = 0.43$ (95% CI: -3.4 to 4.3), $\rho = 0.84$ (95% CI: -3.5 to 5.2) and $\rho = 1.4$ (95% CI: -3.3 to 6.1) in Analyses 1, 2 and 3 respectively).

Table III shows that monthly dispensing of 14 selected medicines increased after the intervention in all three analyses and in both areas. However, the increase was greater in Wales than in NE England (33.1, 13.73 and 14.02 items (per practice per 1000 population) versus 21.21, 7.05 and 4.36 items in Analyses 1, 2 and 3 respectively).

The DiD model suggests that, compared to NE England, Welsh dispensing increased in all analyses ($p < 0.0001$), however, the increase was smaller in Analysis 2 when co-payment was reduced to £3 from £4 (Table IV).

The 11.93 items (per practice per 1000 population) increase in Welsh dispensing of 14 selected medicines is equivalent to roughly 7.7% increase of the average Welsh dispensing

during the period when prescription co-payment was £6 and £4 (Analysis 1, Table V). Corresponding increases in Analyses 2 and 3 were 3.4% and 4.5%, respectively.

We estimated a crude price elasticity of medicines utilisation as -0.23, -0.13 and -0.04 from Analyses 1, 2 and 3 respectively.

<Tables IV and V here>

5. DISCUSSION

Our results suggest that the effect on dispensing of changing co-payment levels is not negligible. The Welsh policy was introduced with an explicit aim to improve health through removal of a (perceived) obstacle to those on low incomes obtaining the medicines they need (WAG, 2003). There is evidence that co-payment poses a barrier to adherence to treatment (Schafheutle, 2003). The increase in dispensing rates for the 14 selected medicines therefore suggests that there may have been a group of non-exempt patients in Wales who were not fully adherent with prescribed treatment before the policy was introduced. The policy may therefore have contributed to reducing patients' non-adherence which in principle should produce an increase in health. A separate study undertaken by the authors suggested that the Welsh policy did not have an impact on consumption of medicines available without prescription from pharmacies (Groves et al, 2010).

The price elasticity of utilisation estimates of -0.23, -0.13 and -0.04 for the three study periods respectively suggest that by the time the co-payment had fallen to a very low level (£3

per item), much of the effect had already occurred and a further fall to zero (abolition) had a lesser impact on dispensing rates than the earlier reductions.

Our study suggests that the utilisation of prescription medicines in Wales is inelastic and implies that consumers are not particularly responsive to changes in co-payments at these levels. This is not uncommon for a tax-financed health care system such as that in the UK, suggesting that consumers in publicly funded health systems appear to be less sensitive to changes in out-of-pocket expenses than consumers in other types of insurance systems (Gemmill *et al.*, 2008).

The low price elasticity estimates here may be due to several factors. Firstly, those patients whose utilisation is likely to be most sensitive to changes in price i.e. those on very low incomes, were already exempt from co-payment. Secondly, elasticity is commonly estimated for small changes in price; here the reductions happened in relatively large increments.

One advantage of our study was its ability to exploit a situation in which the policy on prescription co-payment changed in one area while remaining virtually constant in real terms in another with similar populations and local prescribing policies. Thus differences in dispensing could reasonably be assumed to be due to the Welsh policy on price. A disadvantage of our study, however, was the omission of the 6 month period when the prescription charged moved from £5 to £4, which may have coincided with the highest price elasticity of utilisation. There may also be unobserved confounding factors that were not controlled by comparison with the NE England.

6. CONCLUSIONS

Abolition of co-payments has had a positive but small effect on dispensing rates in Wales. The magnitude of the impact of *reductions* in co-payment shown in this study appears to be broadly similar to those of *increases* in co-payment shown from previous studies. Use of a comparator area avoided the need to use questionable proxies to account for confounding variables but this approach is only possible in rare situations.

Disaggregating the data into three time periods showed most of the effect occurred in response to the earlier reductions from relatively high levels. The response to abolishing a co-payment which has already fallen to a low level is less. Our study presents evidence that could support more detailed descriptions of underlying processes and qualitative analyses to help inform policy decisions.

SOURCE OF FINANCIAL SUPPORT

Wales Office for Research and Development in Health and Social Care (Project: ReF05/1/126)

CONFLICT OF INTEREST

The Authors have no conflict of interest.

ACKNOWLEDGEMENTS

We are grateful to Dr. Susan Myles for her role in the early phases the study and to the members of the study Advisory Group (Prof. Tom Walley, Prof. Chris Brunsdon, Prof. Ceri Phillips and Dr. Mirella Longo). The authors alone are responsible for any errors or omissions in the present paper on the utilisation of selected prescription medicines in Wales.

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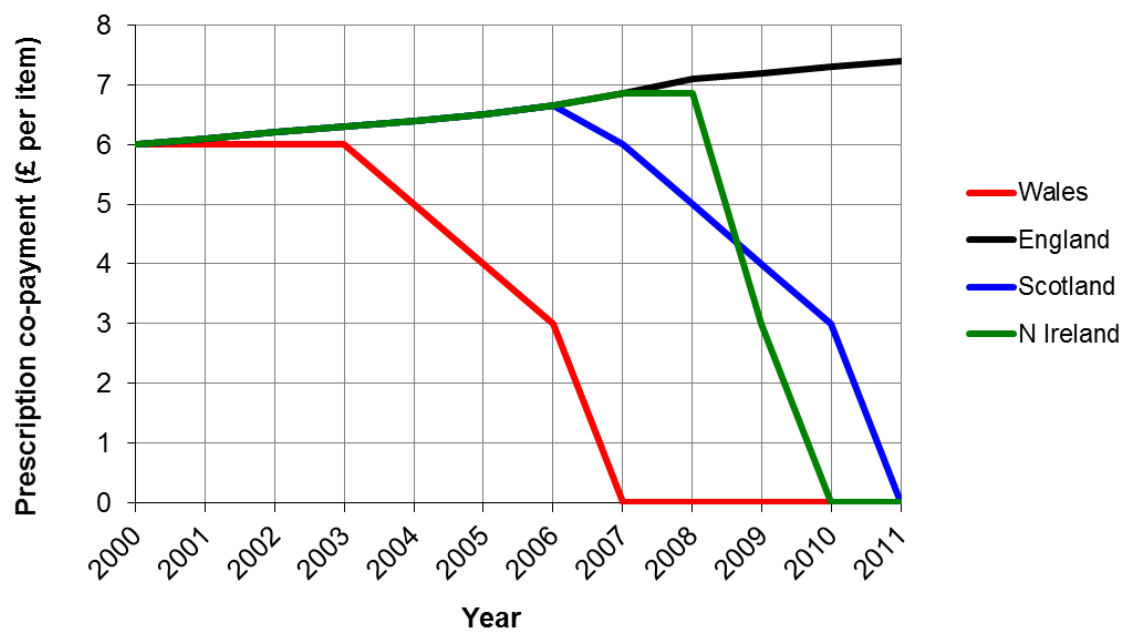


Figure 1. Per item prescription co-payment in Wales, England, Scotland and Northern Ireland: 2000- 2011

Table I. Key health and economic statistics: Wales v NE England

	Wales	NE England
% Reporting good health, 2001	65	64
% Reporting not good health, 2001	12	12
Standardised Mortality Ratio, 2003	105	113
Life expectancy at birth - males, 2001	75.5	74.7
Life expectancy at birth - females, 2001	80.1	79.5
% Population with limiting long term illness, 2001	23	23
% Population with no qualifications, 2004	24	25
% Population claiming income support	8	9
Unemployment rate (%), 2005	5.3	6.2
% Population claiming incapacity benefit/severe disability rate	7	7
Average weekly household total income (£)	410	410
% Population claiming disability allowance, 2002	7	6

Source: Office for National Statistics, UK (2008)

Table II. Monthly number of items dispensed in Wales (14 selected medicines): April, 2005

Medicine	Total	Exempt	Percentage Paid ¹
Phenoxymethylpenicillin tablets 250mg	11,797	9,039	23.38
Amoxicillin capsules 500mg (*)	21,647	16,821	22.29
Erythromycin e/c tablets 250mg (**)	13,706	10,882	20.60
Diclofenac e/c tablets 50mg (**)	17,342	13,851	20.13
Amoxicillin capsules 250mg (*)	41,422	33,102	20.09
Citalopram tablets 20mg	13,172	10,606	19.48
Fluoxetine capsules 20mg	24,349	19,783	18.75
Trimethoprim tablets 200mg	12,986	10,659	17.92
Co-codamol tablets 30mg/500mg	10,417	9,291	10.81
Salbutamol inhaler 100mcg (200 doses)	32,914	29,384	10.72
Atenolol tablets 50mg	45,454	40,660	10.55
Lansoprazole e/c capsules 15mg (**)	23,030	20,753	9.89
Omeprazole e/c capsules 20mg (**)	23,402	21,431	8.42
Bendroflumethiazide tablets 2.5mg	83,094	76,571	7.85
Simvastatin tablets 20mg	22,605	21,611	4.40

Source: Health Solutions Wales (personal communication)

1. Number of items dispensed subject to co-payment/ Total number of items dispensed.

(*) The two strengths for amoxicillin were analysed separately but are considered a single medicine among the 14 medicines selected for this study.

(**) e/c = enteric coated

Table III. Descriptive statistics of monthly dispensing items (per practice per 1000 population) and average co-payment

	October 2003 to September 2004					
	Wales			NE England		
	No. of observations	Mean	SD	No. of observations	Mean	SD
Dispensing rate	5820	155.54	42.15	4716	159.89	46.59
Average co-payment	5820	5.99	0.01	4716	6.33	0.05
	April 2005 to March 2006					
	Wales			NE England		
	No. of observations	Mean	SD	No. of observations	Mean	SD
Dispensing rate	5820	188.64	50.42	4716	181.10	51.91
Average co-payment	5820	3.99	0.01	4716	6.49	0.02
	April 2006 to March 2007					
	Wales			NE England		
	No. of observations	Mean	SD	No. of observations	Mean	SD
Dispensing rate	5820	202.37	53.34	4716	188.15	54.06
Average co-payment	5820	2.99	0.01	4716	6.62	0.02
	April 2007 to March 2008					
	Wales			NE England		
	No. of observations	Mean	SD	No. of observations	Mean	SD
Dispensing rate	5820	216.39	56.61	4716	192.51	56.55
Average co-payment	5820	0.00	0.00	4716	6.83	0.03

Note: Co-payment is deflated by monthly Retail Price Index. During a year, the total number of observations for 'Wales' is 5820 (all practices in Wales, 485 x 12) and the total number of observations for 'NE England' is 4716 (all practices in NE England, 393 x 12).

Table IV. Difference-in-difference estimates, before and after introduction a change in co-payment in Wales

	Difference-in-difference	95% Confidence Interval	<i>p</i> -value
Analysis 1	11.93 ^a	11.21 to 12.65	<0.0001
Analysis 2	6.37 ^a	5.75 to 6.99	<0.0001
Analysis 3	9.18 ^a	8.52 to 9.83	<0.0001

Note: Analysis 1 covers two years of study period when co-payment in Wales was £6 and £4. Analysis 2 covers two years study period when co-payment in Wales was £4 and £3. Analysis 3 covers two years study period when co-payment in Wales was £3 and £0. ^a Monthly number of items dispensed per practice per 1000 population. “Seas 1” (October to December =1, else=0) is a reference category dummy, not included in the model.

Table V. Price elasticity of medicines utilisation in Wales during three study periods

	Percentage change in medicines utilisation in Wales	Percentage change in co-payment in Wales	Price elasticity
Analysis 1	+ 7.67%	-33.39%	- 0.23
Analysis 2	+ 3.38%	-25.06%	- 0.13
Analysis 3	+ 4.54%	-100.0%	- 0.04

Note: Analysis 1 covers two years of study period when co-payment in Wales was £6 and £4. Analysis 2 covers two years study period when co-payment in Wales was £4 and £3. Analysis 3 covers two years study period when co-payment in Wales was £3 and £0.